2. Use of Existing Models to Obtain an HSI

The use of existing habitat models has the advantage of shortening the time required to develop an HSI model. Numerous species-habitat models are available in the literature and others are currently being developed by various researchers (Jenkins 1976; Bovee 1978; Robbins 1978; Aggus and Morais 1979; Binns and Eiserman 1979; Russell et al. 1980).

It is relatively easy to convert existing model outputs to an HSI. The most important step in converting a model output to an HSI is to define a standard of comparison for use in the following equation:

$$HSI = \frac{\text{Existing Model Output for Area of Interest}}{\text{Defined Standard of Comparison}} \quad (3)$$

The following examples demonstrate how some types of model outputs can be converted to an HSI using Formula 3. Note that these conversions do not change any of the assumptions, limitations, or accuracy of the original models.

2.1 Word rankings. Some models may rate habitat by word descriptors such as "excellent", "good", "average", or "below average." If the word descriptors are clearly defined they can be converted to a numerical ranking (Table 2-1). The HSI would equal the rank corresponding to a given model output divided by the highest rank the model could provide, or in this example:

$$HSI = \frac{\text{Output Rank for the Area of Interest}}{4} \quad (4)$$

Table 2-1. Example numerical rankings for outputs of a word model.

Output	Numerical Rank	HSI Value
Excellent	4	1.00
Good	3	0.75
Average	2	0.50
Below average	1	0.25

2.2 Models with defined output units. Models with outputs such as units of standing crop, productivity, or other population measures can easily be converted to an HSI. The basic task is to define a standard of comparison (denominator, Formula 3) that corresponds to the maximum regional value for the predicted measure. For example, the highest long term density observed in a region for a species may equal 60 individuals per square mile. Thus:

$$HSI = \frac{\text{Population Density Estimate (Existing Model Output)}}{60} \quad (5)$$

An HSI computed by this method is dependent upon the value used to represent the standard of comparison. Therefore, in order to make the proper comparisons between alternatives, it is important that one standard of comparison be used consistently throughout a study.

Several models with defined output units are available. Tested and scaled regression models relating habitat variables to population measures are available for reservoir fishes (Jenkins 1976; Leidy and Jenkins 1977) and some stream fishes (Binns and Eiserman 1979) and should be reviewed for potential HEP applications. Aggus and Morais (1979) presented a method for converting fish standing crop estimates in warmwater reservoirs to an HSI by using standing crop data; this is a nonlinear model that must be converted to a linear relationship for use in HEP. Robbins (1978) developed a model that predicts abundance for seven avian species in eastern deciduous forests. Models based on statistical methods that predict population densities of terrestrial species have been developed by Russell et al. (1980). These models use conditional probability statements derived through habitat observations in areas of both high and low population densities.

2.3 Models with undefined output units. The output of a model may be in the form of a numerical rating or an index. For example, habitats may be ranked from 1 to 5 with 5 being the best available habitat. In this example, the HSI would be computed by defining the denominator as the highest rank given by the model:

$$HSI = \frac{\text{Rank Provided by the Model for the Area of Interest}}{5} \quad (6)$$

348-753 O - 81 - 2

2. Use of Existing Models to Obtain an HSI

Baskett et al. (1980) compiled habitat models for eight game and nine nongame species found in central Missouri. These models output an undefined "Habitat Unit Value" for the various habitat types used by a particular species. The conversion of this output to an HSI requires the division of the Habitat Unit Value by the maximum possible value defined on the habitat type score form.

Another model with undefined output units has been developed by the USFWS's Cooperative Instream Flow Service Group. This method is used to assess a change in fish stream habitat potential in response to a change in stream flow or channel configuration (Bovee 1978; Stalnaker 1978; Stalnaker 1980). This method involves modeling habitat within selected stream reaches. The output of this model is Weighted Useable Area (WUA) for appropriate life stages (spawning, incubation, fry, juvenile, and adult) at monthly intervals (Stalnaker 1980). Conversion of WUA to an HSI for a given life stage involves two steps.

The first step is to convert the monthly WUA values to a single WUA value for the life stage. Suggested conversion techniques are: (1) select the WUA for a critical month; (2) calculate a mean WUA for a critical season; or (3) calculate a mean WUA for an entire 12-month period.

The second step in converting WUA to an HSI value is to use the WUA determined above and calculate a life stage HSI using the following formula:

$$HSI_i = \frac{\text{Weighted Useable Area of Stream Reach (Critical Month or Mean)}}{\text{Wetted Surface Area of the Same Stream Reach (Critical Month or Mean)}} \quad (7)$$

where: i = Spawning, incubation, fry, juvenile, or adult life stage.

Individual life stage HSI values may be aggregated into a species HSI value using the techniques described in 103 ESM 3.3.

2.4 Sources of information. The species-habitat information needed to develop or modify habitat models is available from many sources, but is often difficult to locate. Many State and Federal natural resource agencies have file information that is useful in constructing habitat models. Other sources include standard library references and research institutions that are active in ecological studies. The following specific sources are included because of the known availability and uniqueness of the habitat information:

2. Use of Existing Models to Obtain an HSI

A. Bureau of Land Management. The Bureau of Land Management (BLM) published a series of Technical Notes that provide information on habitat requirements for many species. These Technical Notes can be obtained from:

Bureau of Land Management
U.S. Department of the Interior
Denver Service Center
Federal Center Building #50
Denver, Colorado 80225

B. U.S. Forest Service. The U.S. Forest Service is compiling habitat information for vertebrates under an effort entitled "Forest Service Fish and Wildlife Habitat Relationships System." This is an effort to compile basic ecological data that are useful for determining the value of habitat to wildlife for land use planning purposes. Information on this effort can be obtained from the Director of Fish and Wildlife Management at either the Washington Office or Regional Offices of the Forest Service.

U.S. Forest Service
P.O. Box 2417
Washington, D.C. 20013

C. Western Energy and Land Use Team. The Western Energy and Land Use Team (WELUT) of the USFWS has developed models for selected species of fish and wildlife. Lists of current models can be obtained by writing:

Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2625 Redwing Road
Fort Collins, Colorado 80526

D. Eastern Energy and Land Use Team. A computerized procedure for storing fish and wildlife information data on a state-by-state basis has been developed by the Eastern Energy and Land Use Team. Current information concerning those States with available data can be obtained from:

Eastern Energy and Land Use Team
U.S. Fish and Wildlife Service
Kearneysville, West Virginia 25430

E. Migratory Bird and Habitat Research Laboratory. The USFWS Patuxent Wildlife Research Center has a large data base for migratory birds. This includes information on habitat requirements and other data useful in habitat modeling.

Migratory Bird and Habitat Research Laboratory
Patuxent Wildlife Research Center
Laurel, Maryland 20811

F. Boise District, BLM. Information is available for western birds of prey, including results from recent studies of habitat preference and home range.

Snake River Birds of Prey Study
Boise District, Bureau of Land Management
230 Collins Road
Boise, Idaho 83702

G. Appalachian Environmental Laboratory. Research has been conducted relating the vegetative characteristics and nest sites of woodland hawks.

Appalachian Environmental Laboratory
University of Maryland
Frostburg State College Campus
Frostburg, Maryland 21532

H. Waterways Experiment Station. Information is available concerning river and oxbow lake habitat requirements for fishes of the southeastern U.S.

Waterways Experiment Station
U.S. Army Corps of Engineers
Vicksburg, Mississippi 39180

2. Use of Existing Models to Obtain an HSI

I. National Reservoir Research Program. Information has been collected relating reservoir standing crop and harvest data to habitat variables.

U.S. Fish and Wildlife Service
National Reservoir Research Program
100 W. Rock Street
Fayetteville, Arkansas 72701

J. Cornell University. Data are available regarding breeding distribution, and nesting habitat and success for North American birds.

Nest-Record Card Program
Laboratory of Ornithology
Cornell University
Ithaca, New York 14850

K. Seattle National Fishery Research Center. Data have been collected on the winter habitat requirements of fishes in Alaska.

Seattle National Fishery Research Center
Bldg. 204, Naval Support Activity
Seattle, Washington 98115